SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
LEVELS WITH INTELLIGENT ROUTING
Inven⬤ Eric Klinker, et al.
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FIG. 1 A

Fig. 1B

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
LEVELS WITH INTELLIGENT ROUTING
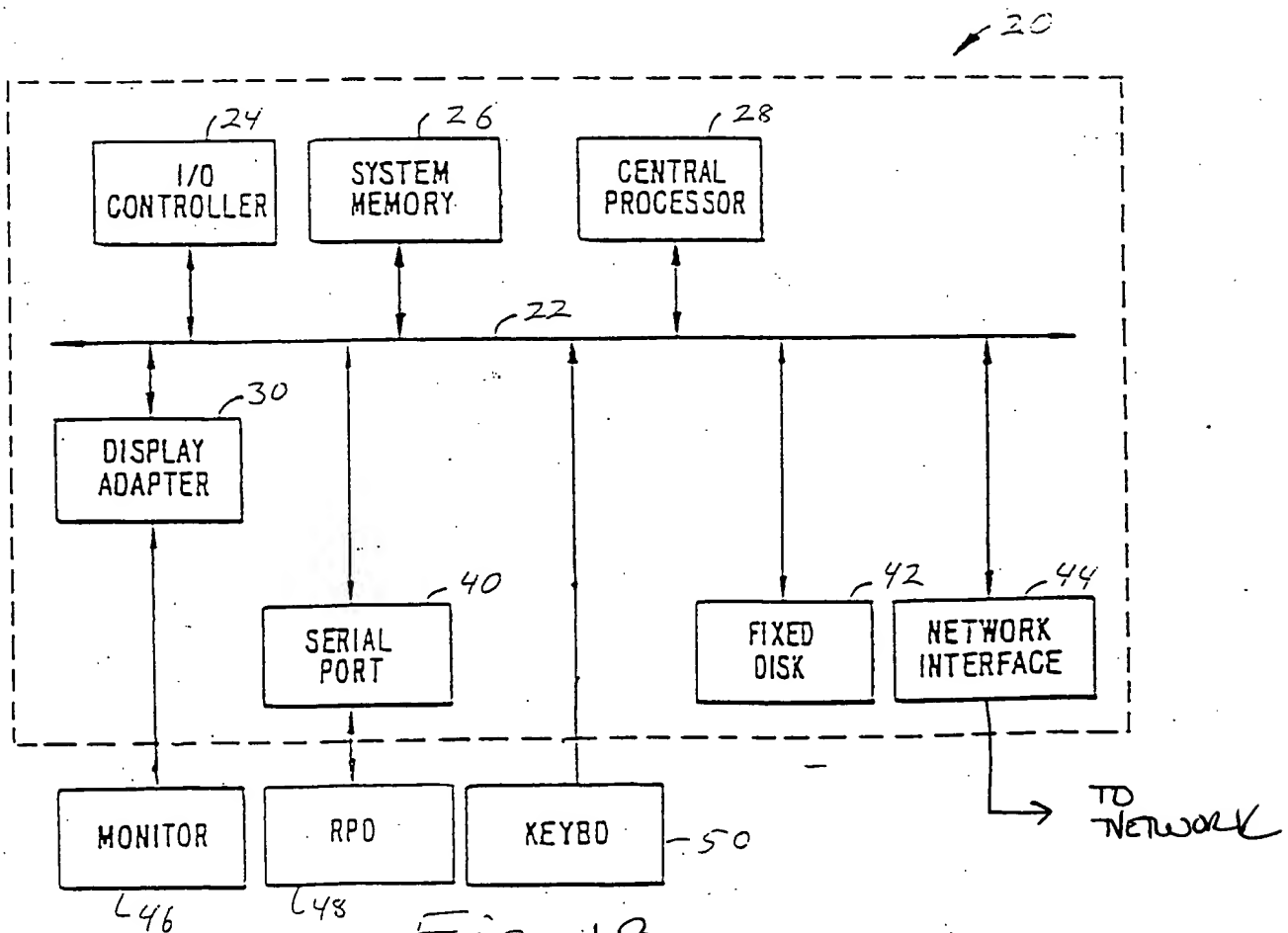Inventor Eric Klinker, et al.
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Fig. 1c

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
LEVELS WITH INTELLIGENT ROUTING
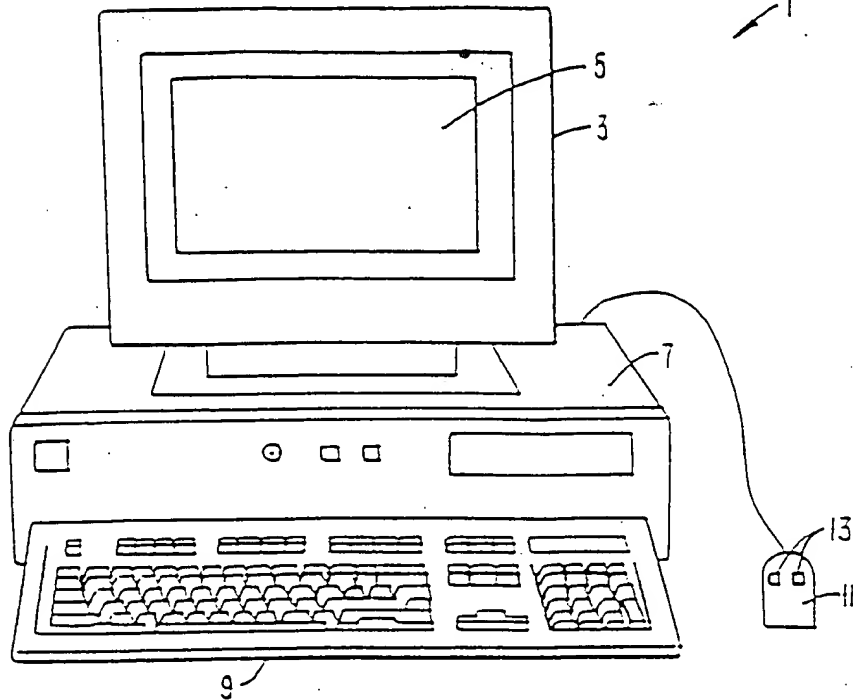Inventor: Eric Klinker, et al.
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FIGURE 2

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FIGURE 8

PROBE

TARGET

RTT

809

812

813

814

815

816

817

818

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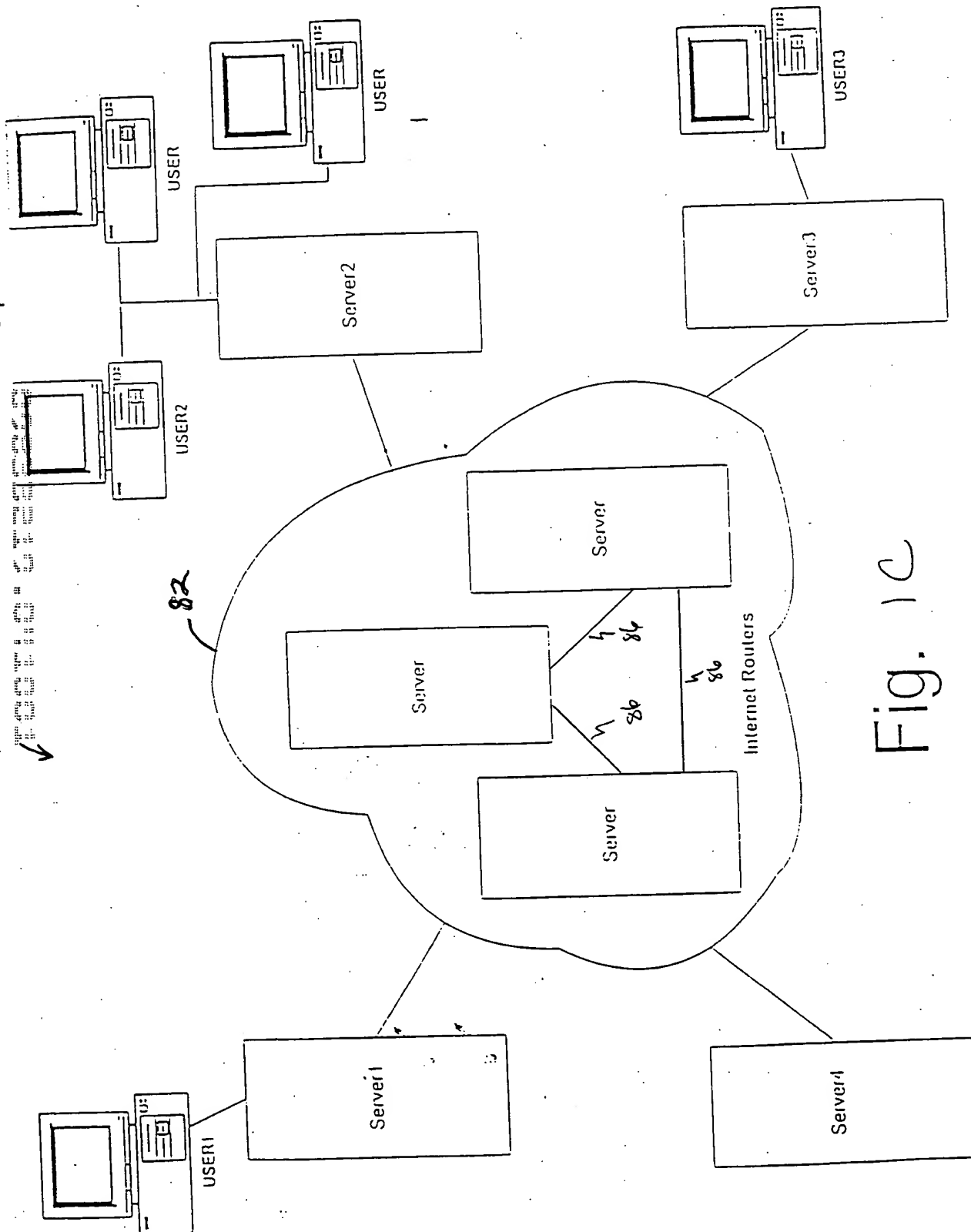Towns   and Townsend and Crew LLP   5 of 23

FIG 4A

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
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FIG 4B

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NEW YORK

WASHINGTON DC

ATLANTA

CHICAGO

Path 2

273

DALLAS

272

Path 1

270

271
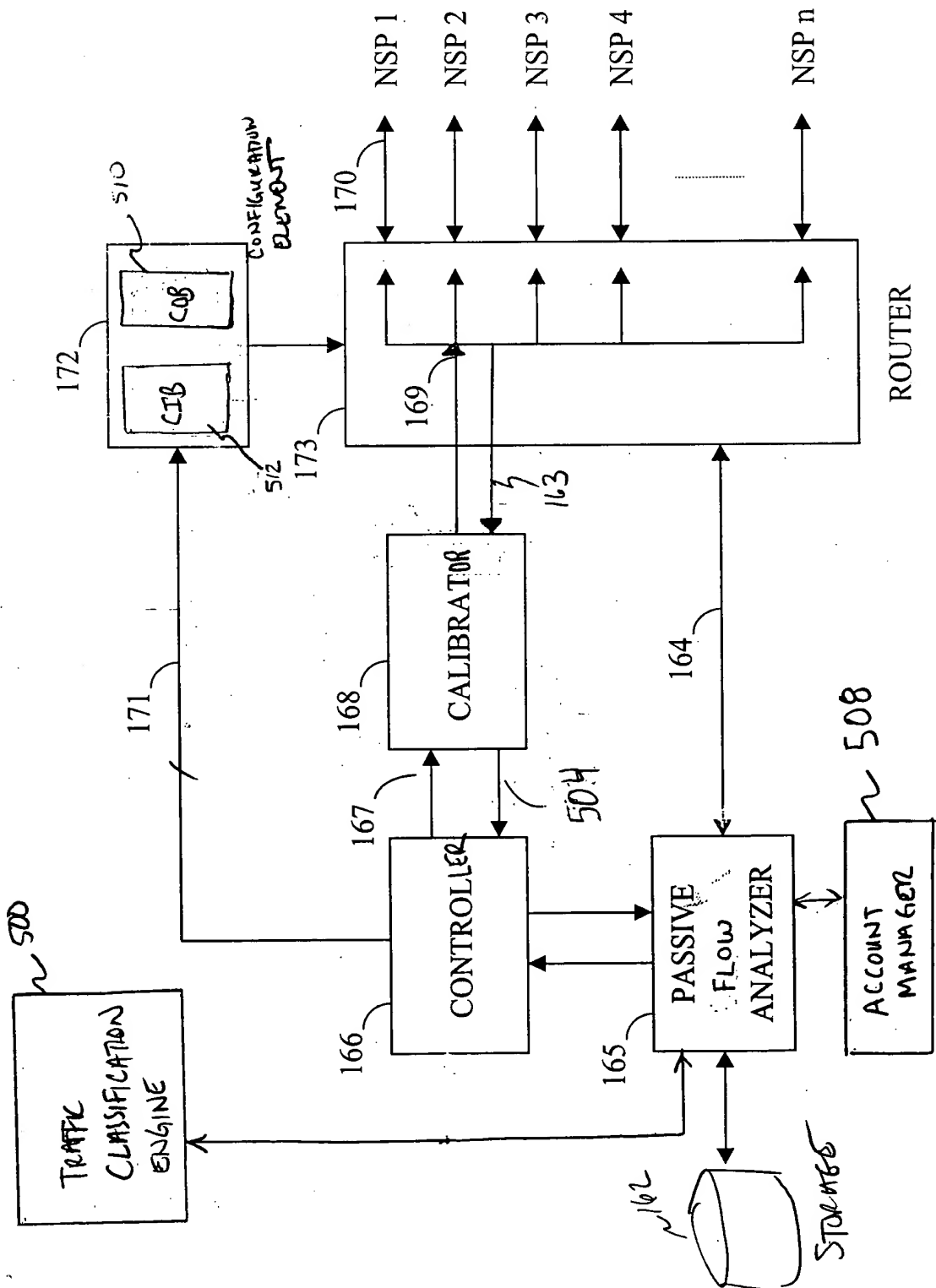
SEATTLE

SAN JOSE

LOS ANGELES

FIGURE 27

Figure 5

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
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FIGURE 6

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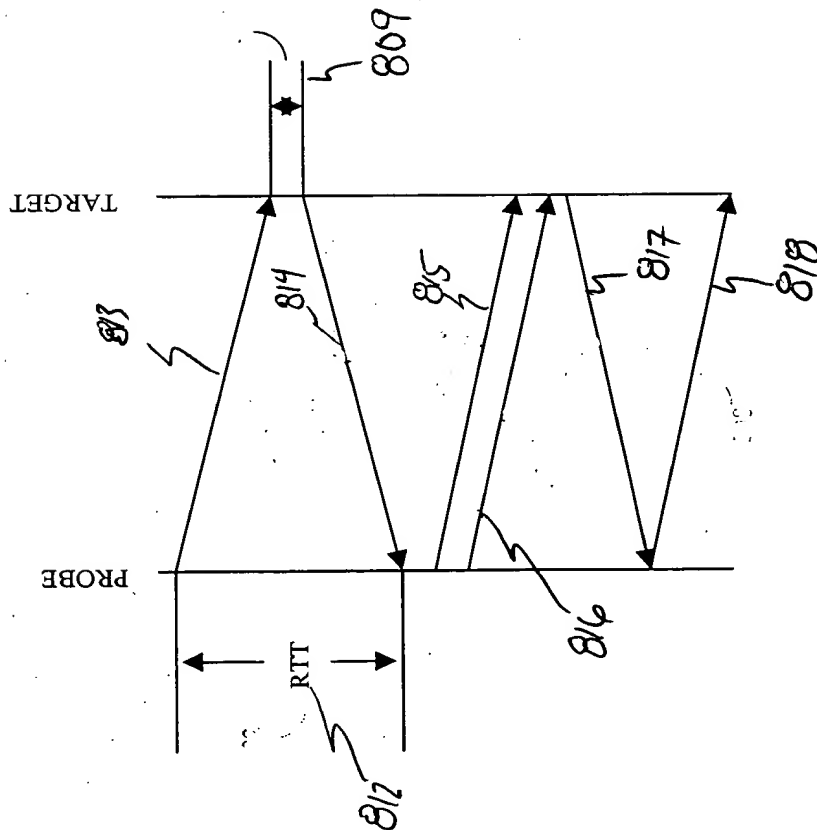
FIGURE 7

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150

181

CONFIG ELEMENT

CIR | CDB

159

ROUTER

177

NSP 1

NSP 2

NSP 3

NSP 4

NSP n

176

160

175

CALIBRATOR

178

STORAGE

179

164

180

OPTIMIZER

CONTROLLER

FIGURE 8

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
LEVELS WITH INTELLIGENT ROUTING
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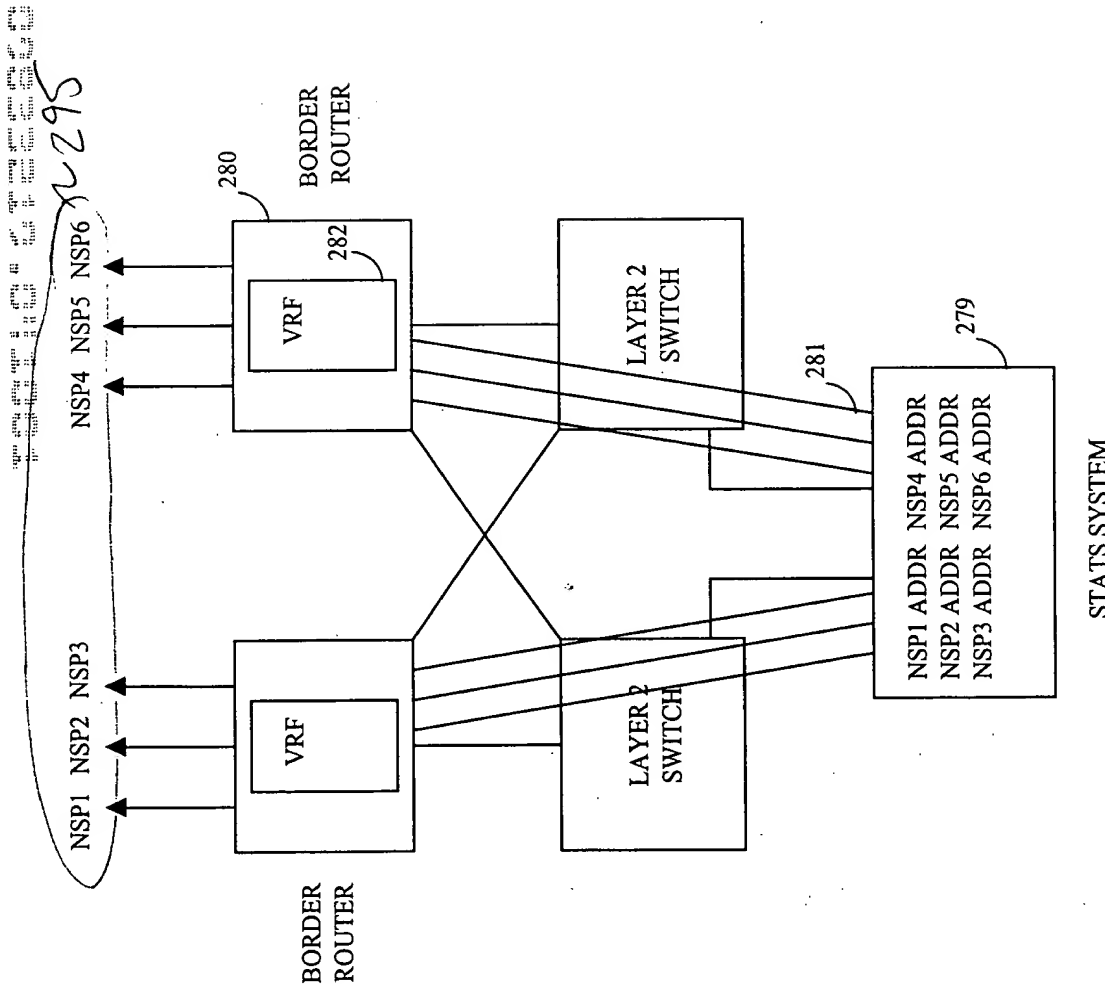Townsend and Townsend and Crew LLP   11 of 23

BGP4 Feed From All NSPs

191

Route Server

182

BGP4 ENGINE

183

BGP4 ROUTING TABLE

184

Route Modulator

188

MODIFIED BGP ROUTING TABLE

189

Feed To All BGP Clients

712

185

Controller

PATH OPTIMIZATION

PATH CHARACTERIZATION

186

TRAFFIC ANALYSIS

187

from Storage 178

from Calibrator 168

FIGURE 9

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Tov████nd and Townsend and Crew LLP   12 ████ 5

FIGURE 1b

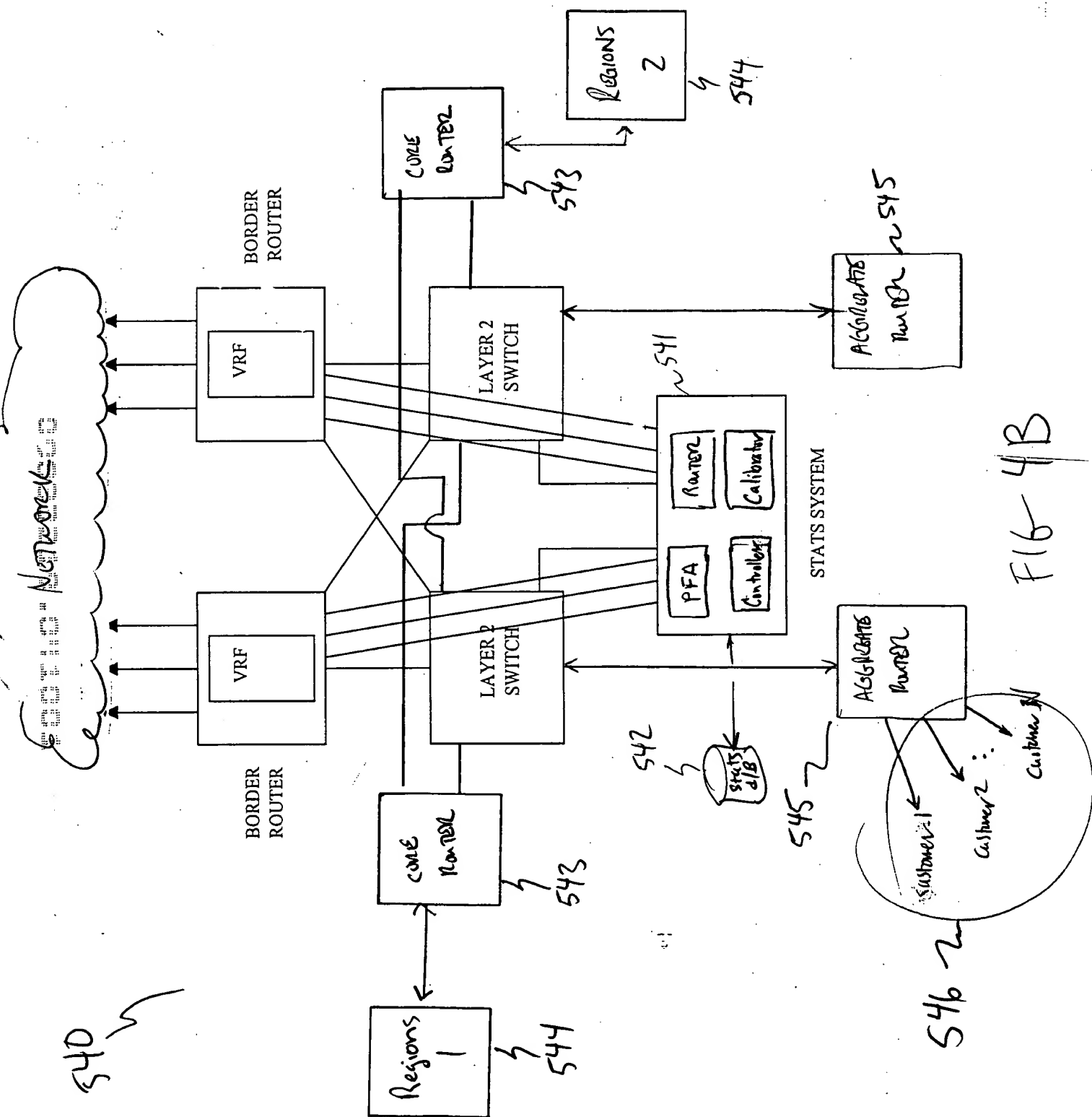SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
LEVELS WITH INTELLIGENT ROUTING
Inventor: Eric Klinker, et al.
Our Ref: 021089-000100   (415) 576-0200
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Destination

AT&T

Tier2 ISP

UUNet

Ingress path one

C&W

Ingress path two

Sprint

Ingress path three

264

265

266

263

UUNet Source
C&W Source
Sprint Source

(Provider Supplied
Address)

Destination

AT&T

Tier2 ISP

UUNet

Ingress path one

C&W

Ingress path two

Sprint

Ingress path three

278

277

276

275

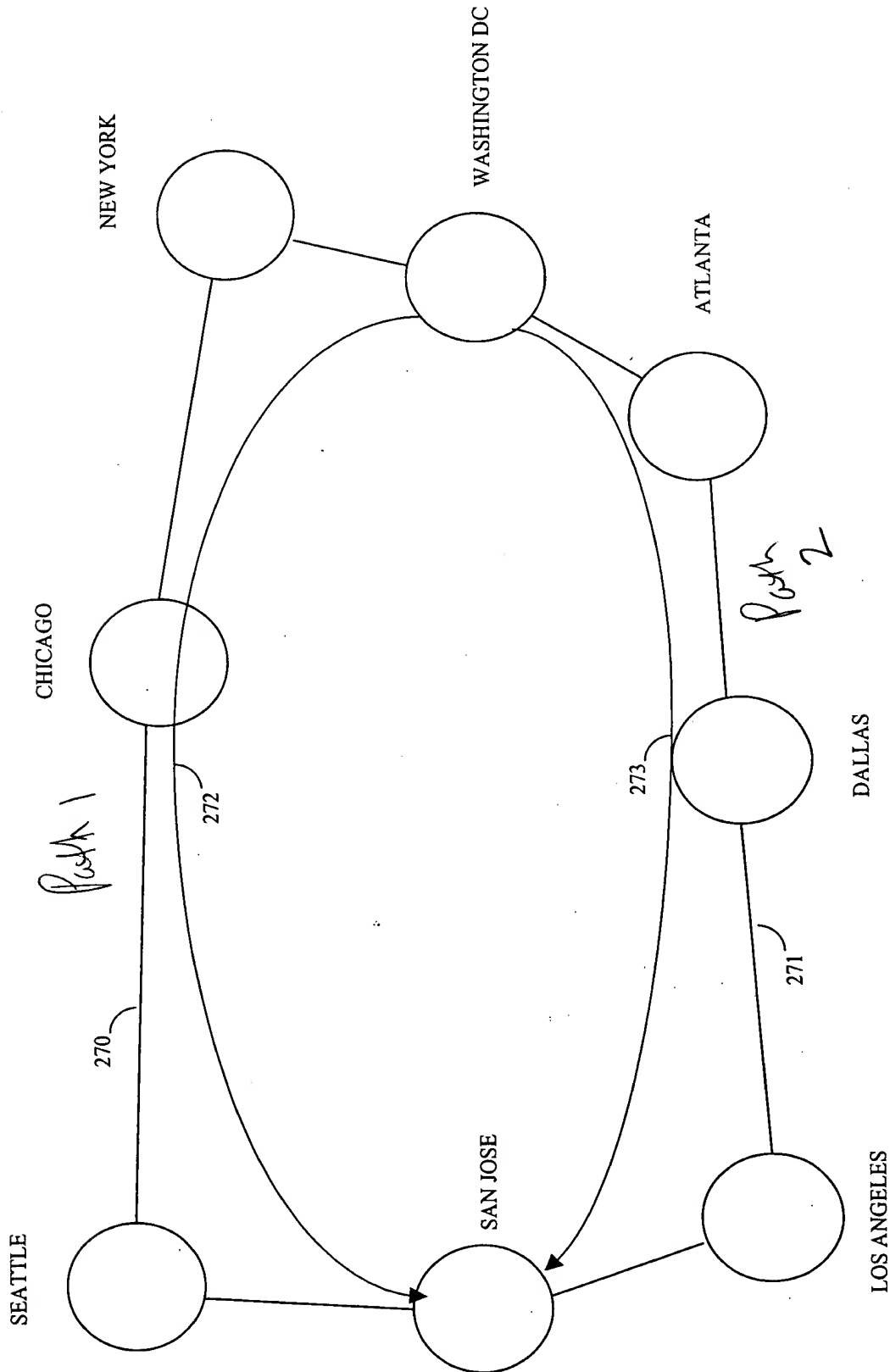UUNet Source
C&W Source
Default Source

274

FIGURE 11

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
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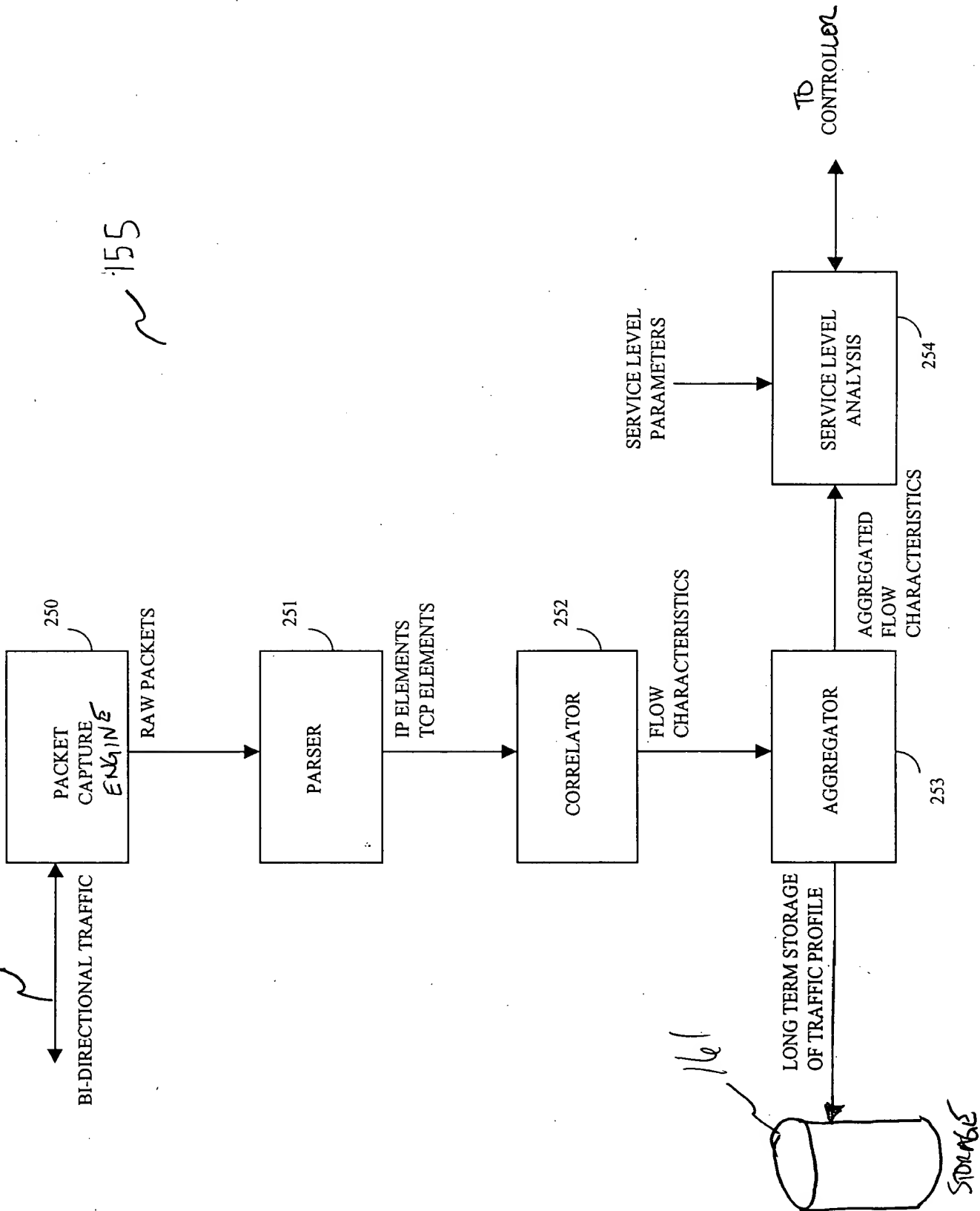
Figure 12

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FIGURE 17

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
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FIGURE 14

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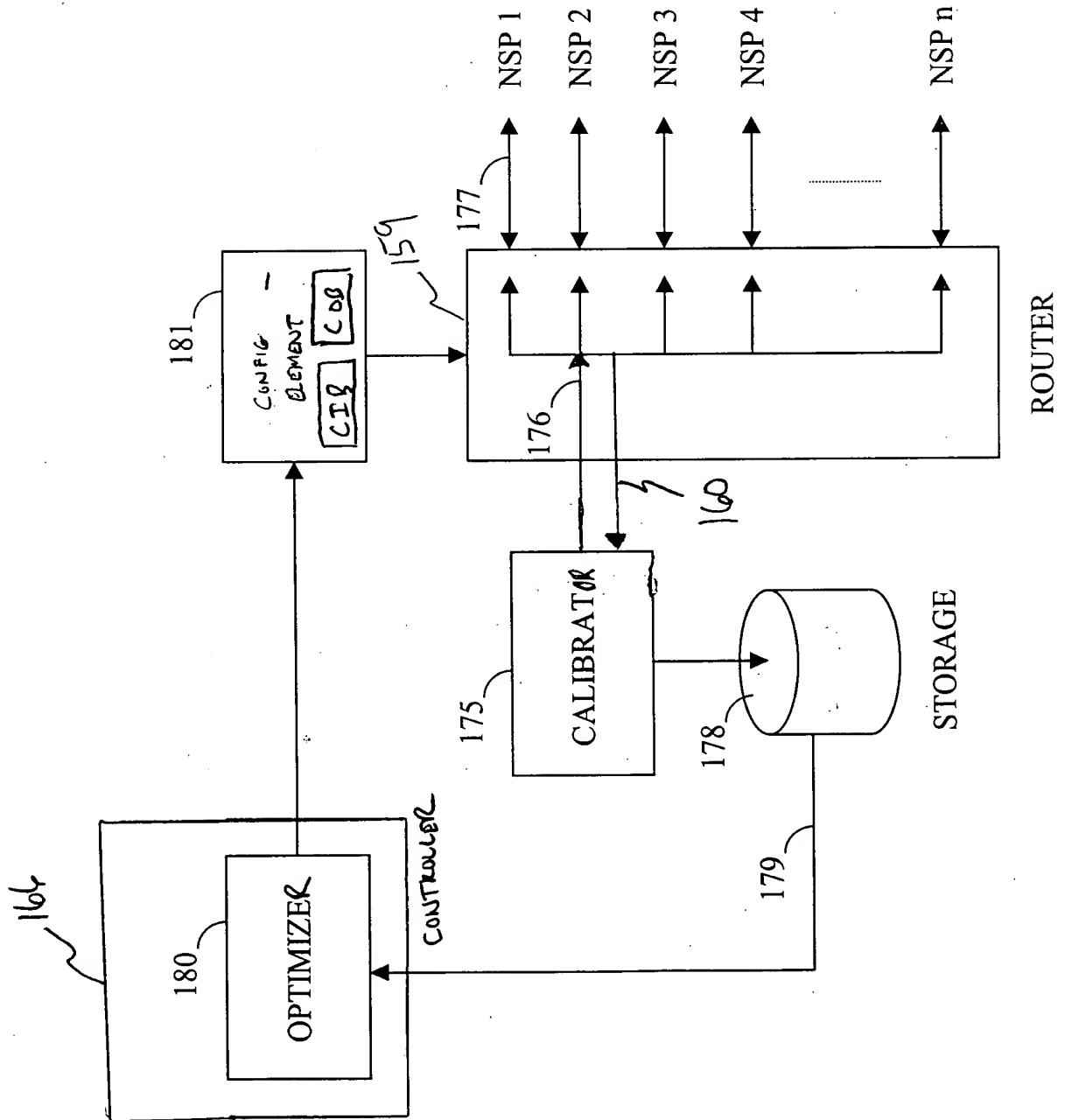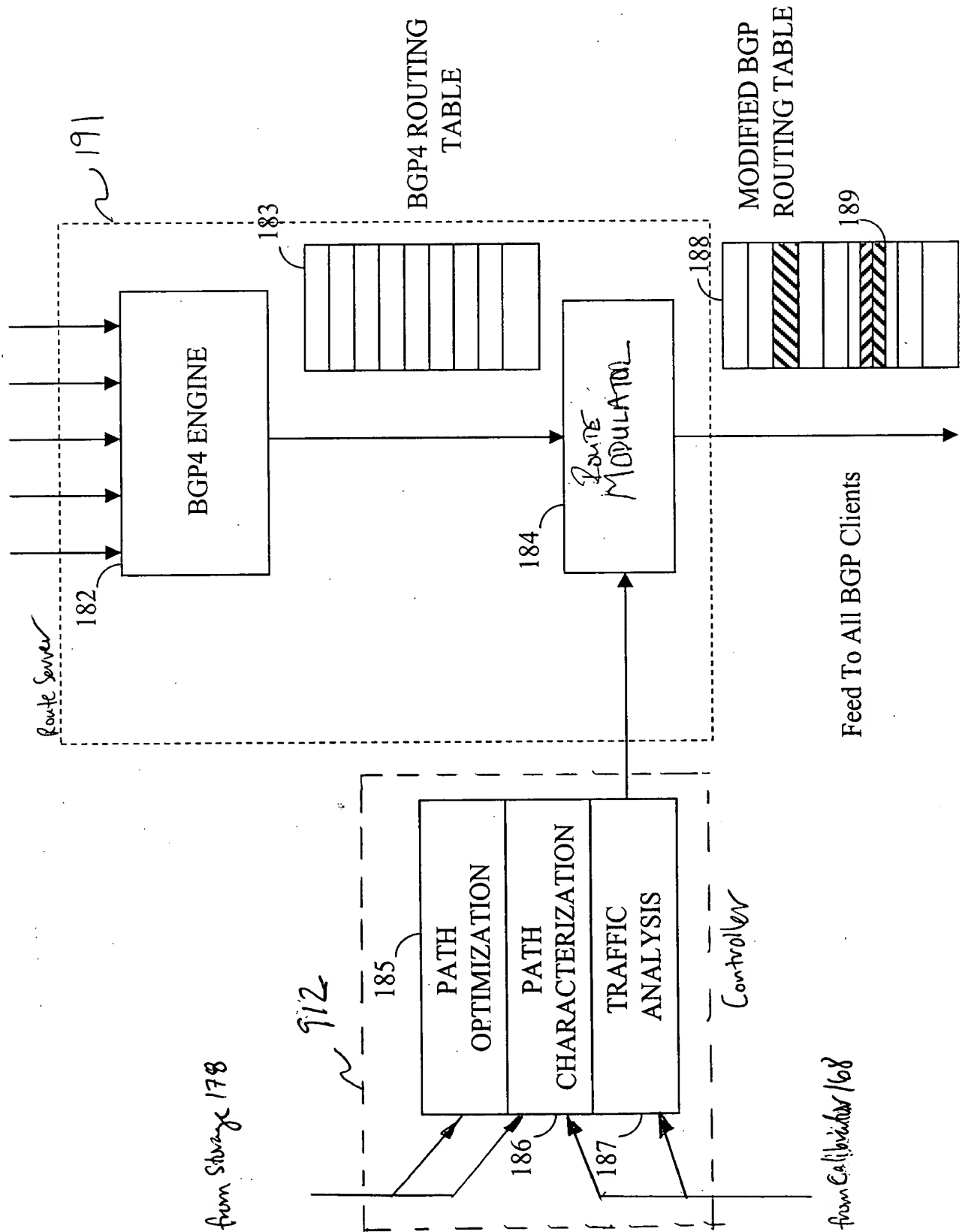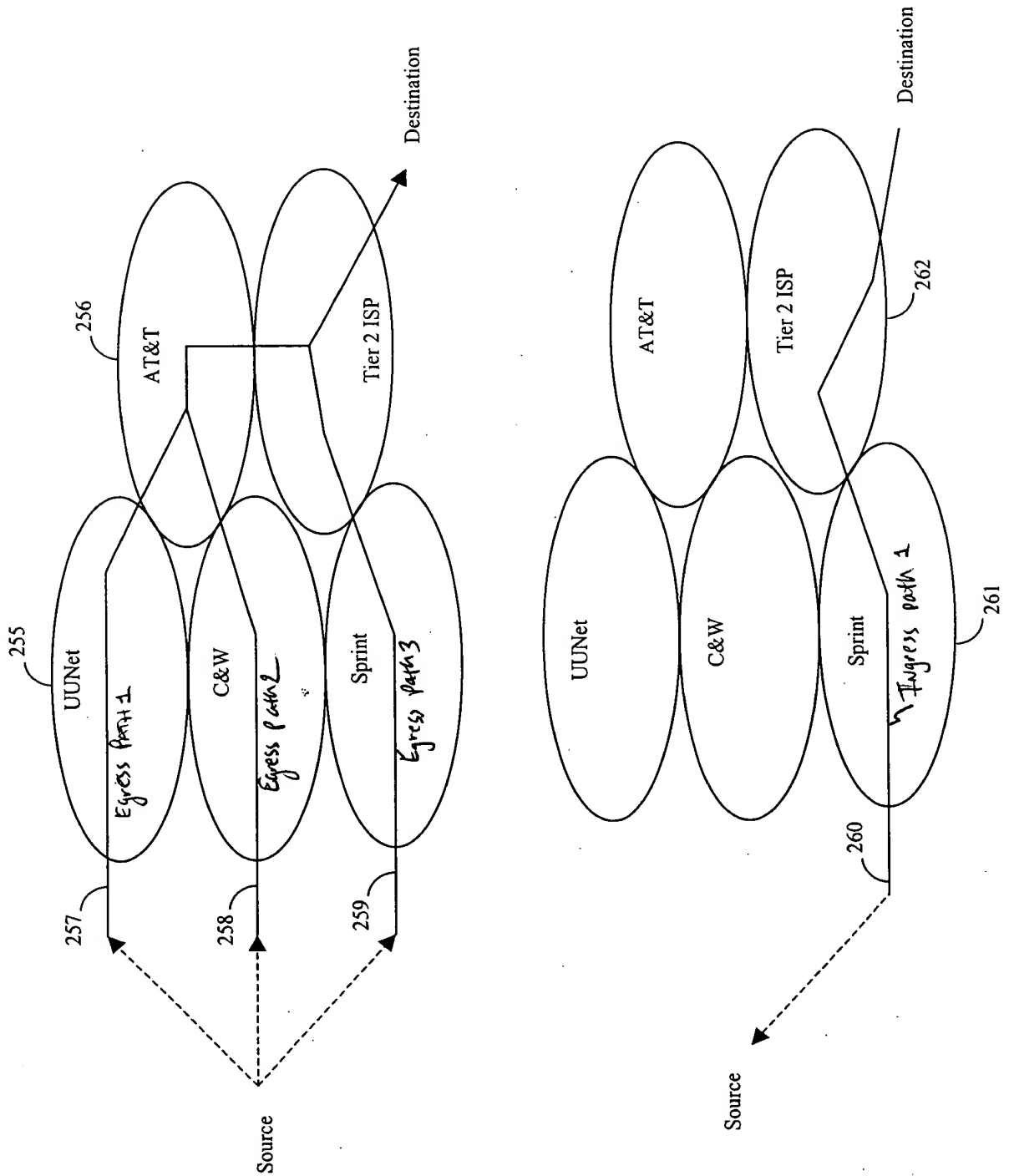Townsend and Townsend and Crew LLP   17 of 23

FIG 15

POP 1

POP 2

POP 3

iBGP
To Local Routers

iBGP
To Local Routers

iBGP
To Local Routers

1.1.1.1   1.1.1.2   1.1.1.3

2.2.2.1   2.2.2.2   2.2.2.3

3.3.3.1   3.3.3.2   3.3.3.3

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		1.1.1.1
1.0.0.0/8	100	1_3_2		1.1.1.2
1.0.0.0/8	100	1_4_2		1.1.1.3

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		2.2.2.1
1.0.0.0/8	100	1_3_2		2.2.2.2
1.0.0.0/8	100	1_4_2		2.2.2.3

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		3.3.3.1
1.0.0.0/8	100	1_3_2		3.3.3.2
1.0.0.0/8	100	1_4_2		3.3.3.3

210   211   212   213

iBGP

iBGP

iBGP

iBGP

214

Central/Regional
SYSTEM

209

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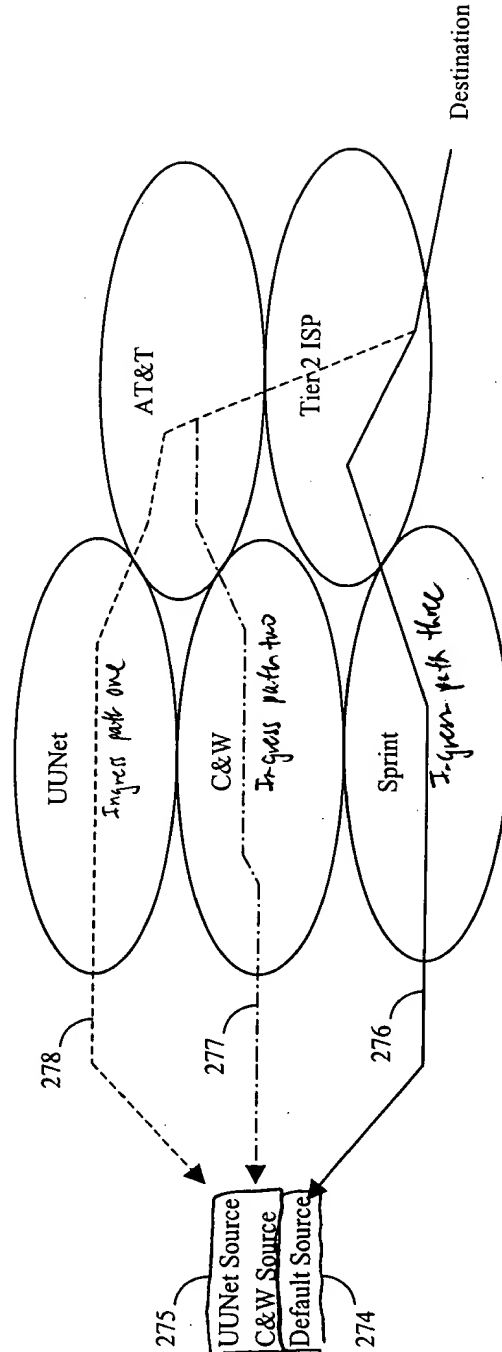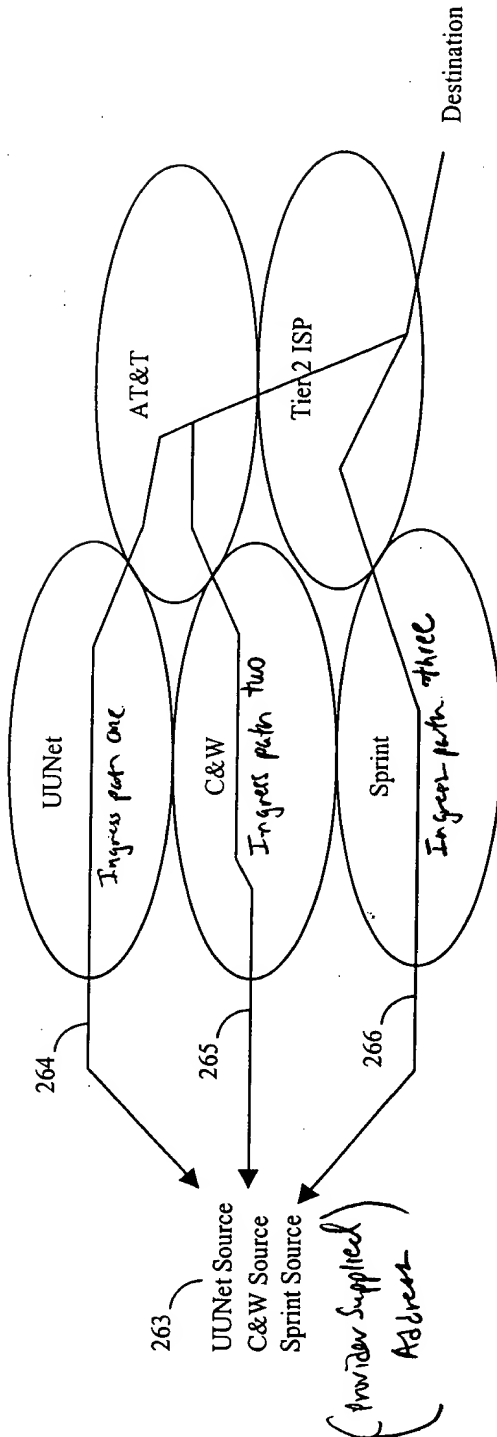Townsend and Townsend and Crew LLP   18 of 23

FIG 16

POP 3 — 3.3.3.1   3.3.3.2   3.3.3.3 — iBGP — To Local Routers

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		3.3.3.1
1.0.0.0/8	100	1_3_2		3.3.3.2
1.0.0.0/8	100	1_4_2		3.3.3.3

POP 2 — 2.2.2.1   2.2.2.2   2.2.2.3 — iBGP — To Local Routers

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		2.2.2.1
1.0.0.0/8	100	1_3_2		2.2.2.2
1.0.0.0/8	100	1_4_2		2.2.2.3

POP 1 — 1.1.1.1   1.1.1.2   1.1.1.3 — iBGP — To Local Routers

Route	pref	AS P		Next Hop
1.0.0.0/8	100	1_2		1.1.1.1
1.0.0.0/8	100	1_3_2		1.1.1.2
1.0.0.0/8	100	1_4_2		1.1.1.3
1.0.0.0/8	200	1_3_2		1.1.1.2

217

RESOLVED

1.0.0.0/8 200 1_3_2 1.1.1.2

218

iBGP   iBGP   iBGP   iBGP

PFA — 215

SLA Violation
to 1.0.0.0/8

CONTROL — 216

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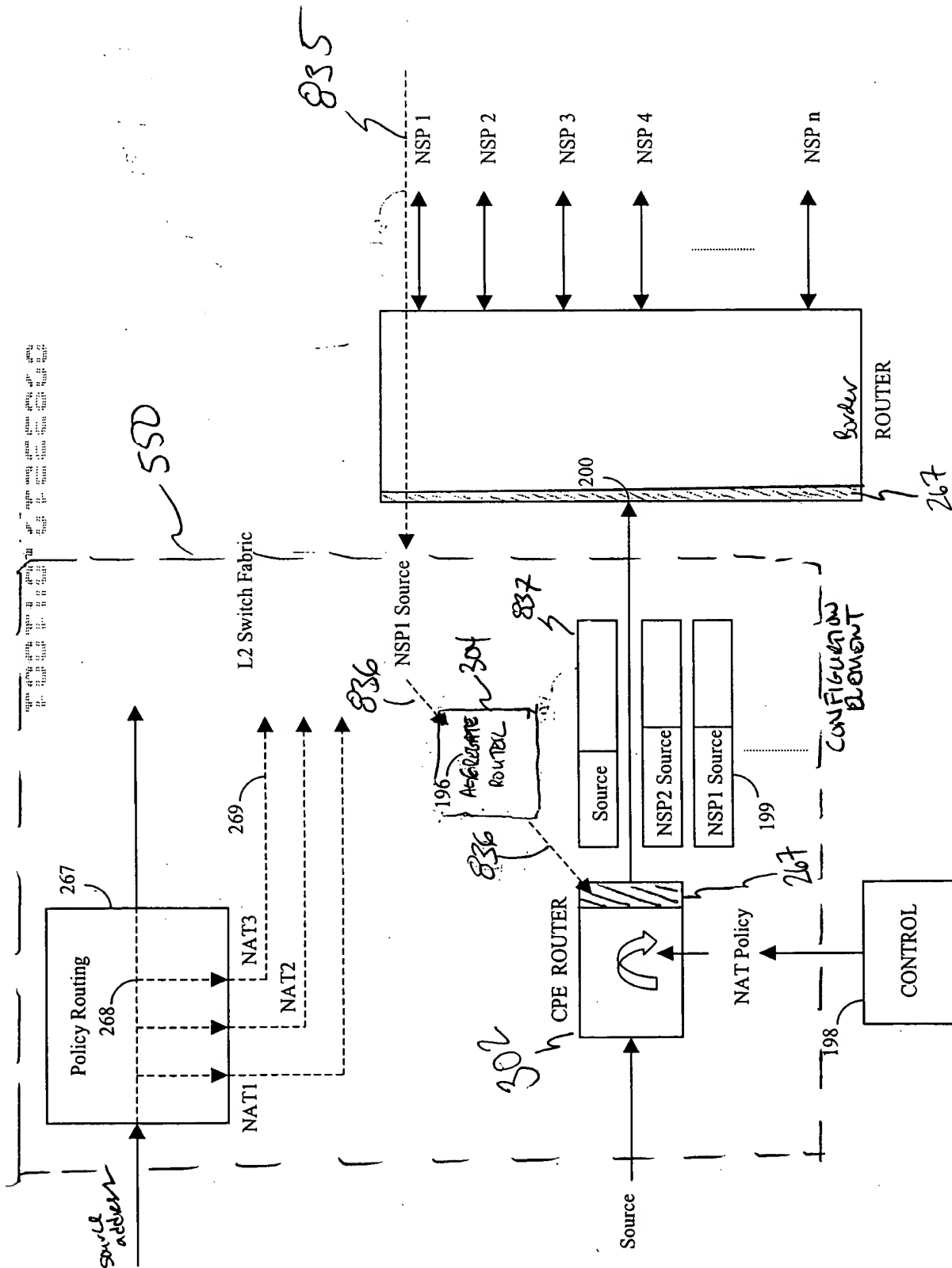
FIG 17

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LEVELS WITH INTELLIGENT ROUTING
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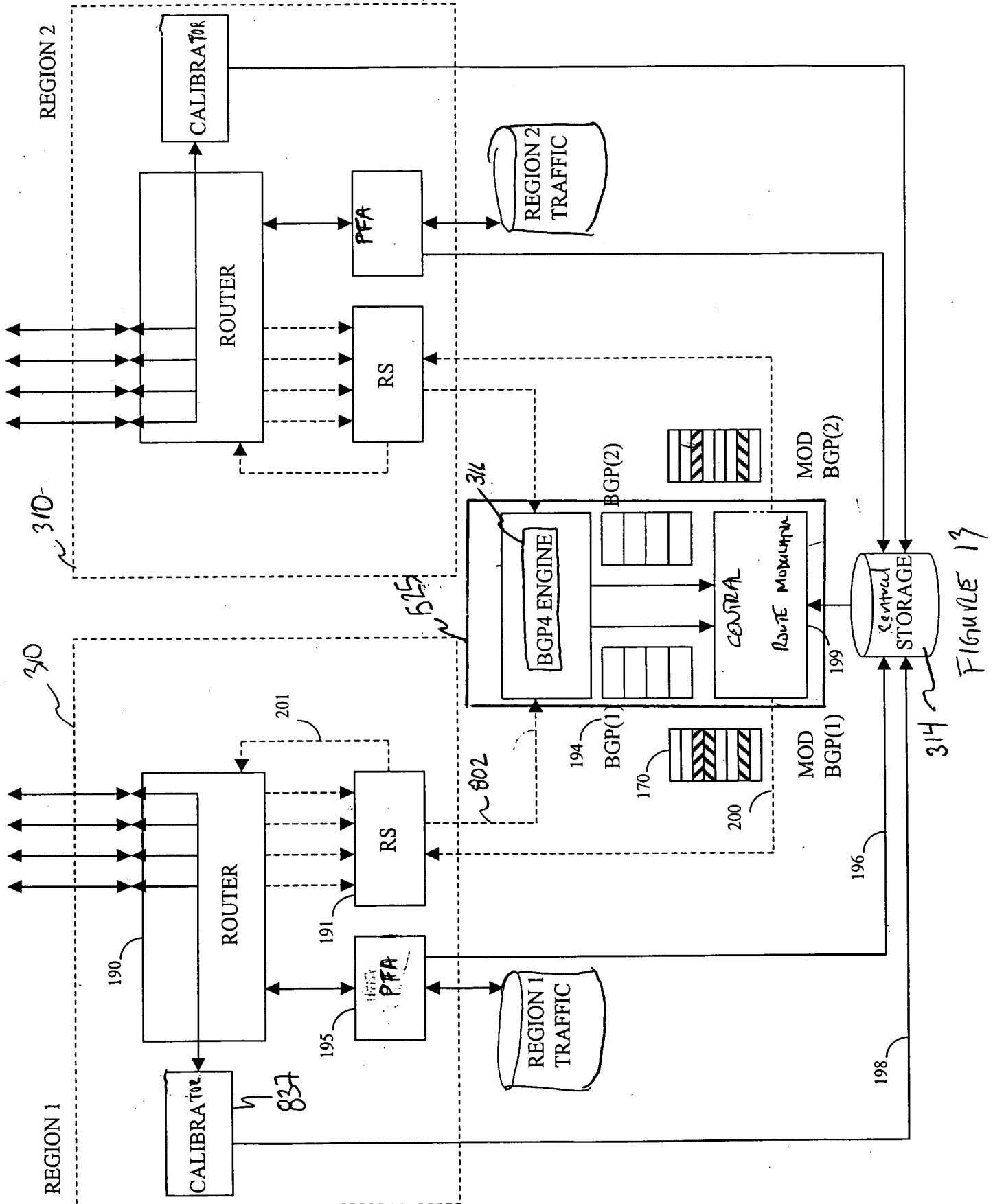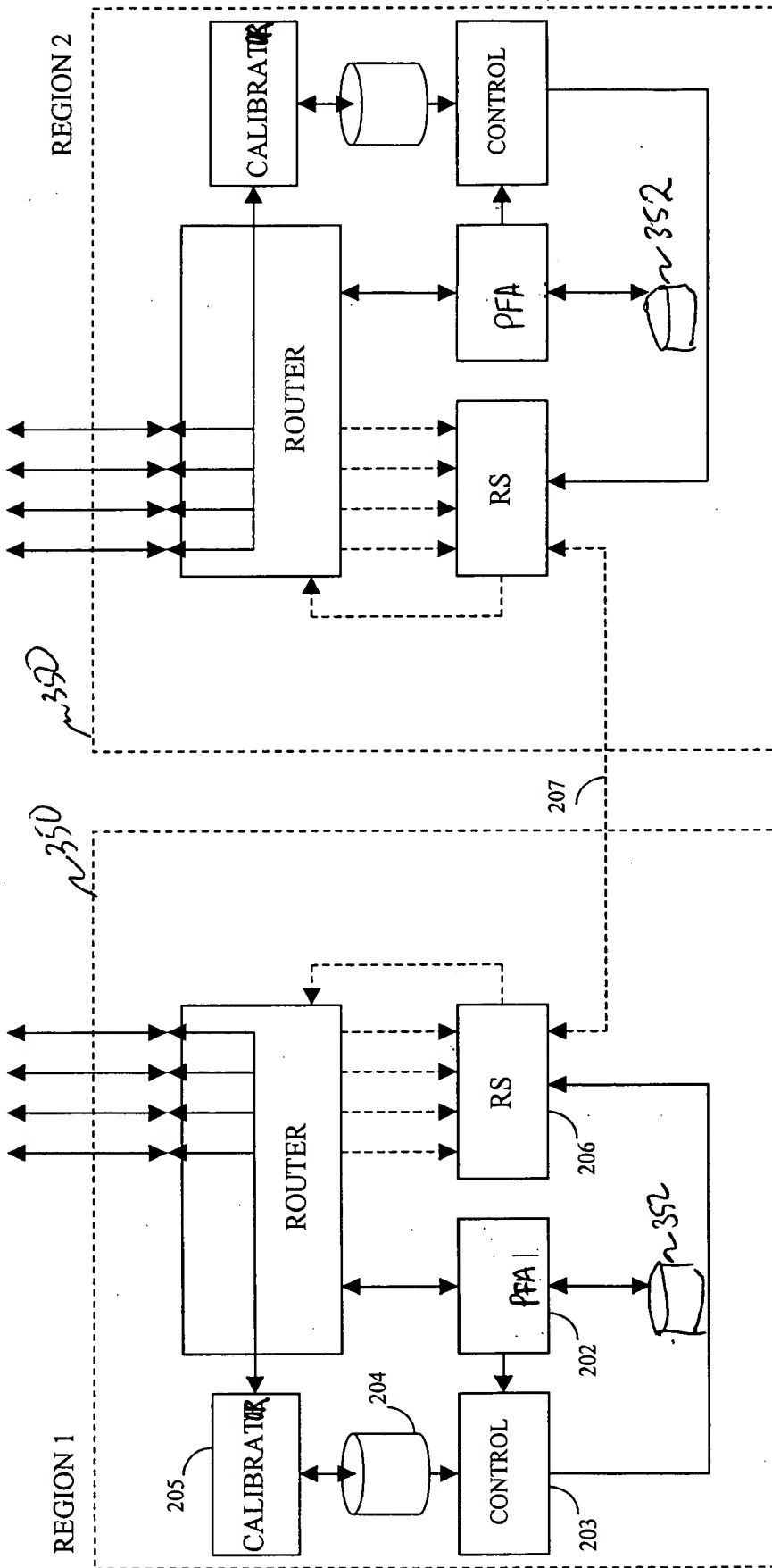Townsend and Townsend and Crew LLP   20 of 23

FIG 18

POP 3 — inputs: 3.3.3.1 3.3.3.2 3.3.3.3

Table 224 (POP 3):

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	3.3.3.1
1.0.0.0/8	100	1_3_2	3.3.3.2
1.0.0.0/8	100	1_4_2	3.3.3.3
1.0.0.0/8	10	1_3_2	1.1.1.2
1.0.0.0/8	200	1_2	3.3.3.1

226: 1.0.0.0/8 200 1_2 3.3.3.1 3:40 3:1

POP 2 — inputs: 2.2.2.1 2.2.2.2 2.2.2.3

Table 223 (POP 2):

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	2.2.2.1
1.0.0.0/8	100	1_3_2	2.2.2.2
1.0.0.0/8	100	1_4_2	2.2.2.3
1.0.0.0/8	10	1_3_2	1.1.1.2
1.0.0.0/8	200	1_3_2	2.2.2.2

225: 1.0.0.0/8 200 1_3_2 2.2.2.2 2:50ms 2:2%

POP 1 — inputs: 1.1.1.1 1.1.1.2 1.1.1.3

Table 230 (POP 1):

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	1.1.1.1
1.0.0.0/8	100	1_3_2	1.1.1.2
1.0.0.0/8	100	1_4_2	1.1.1.3
1.0.0.0/8	200	1_3_2	1.1.1.2
1.0.0.0/8	300	1_2	3.3.3.1

229: 1.0.0.0/8 300 1_2 3.3.3.1

340 / 227 CONTROL

Table 228:

Route	pref	AS P	Next Hop	
1.0.0.0/8	200	1_3_2	1.1.1.2	1:HLP
1.0.0.0/8	10	1_3_2	1.1.1.2	
1.0.0.0/8	200	1_3_2	2.2.2.2	2:50 2:2
1.0.0.0/8	200	1_2	3.3.3.1	3:40 3:1
1.0.0.0/8	300	1_2	3.3.3.1	

iBGP   To Local Routers

PFA — SLA Violation to 1.0.0.0/8

SYSTEM AND METHOD TO ASSURE NETWORK SERVICE
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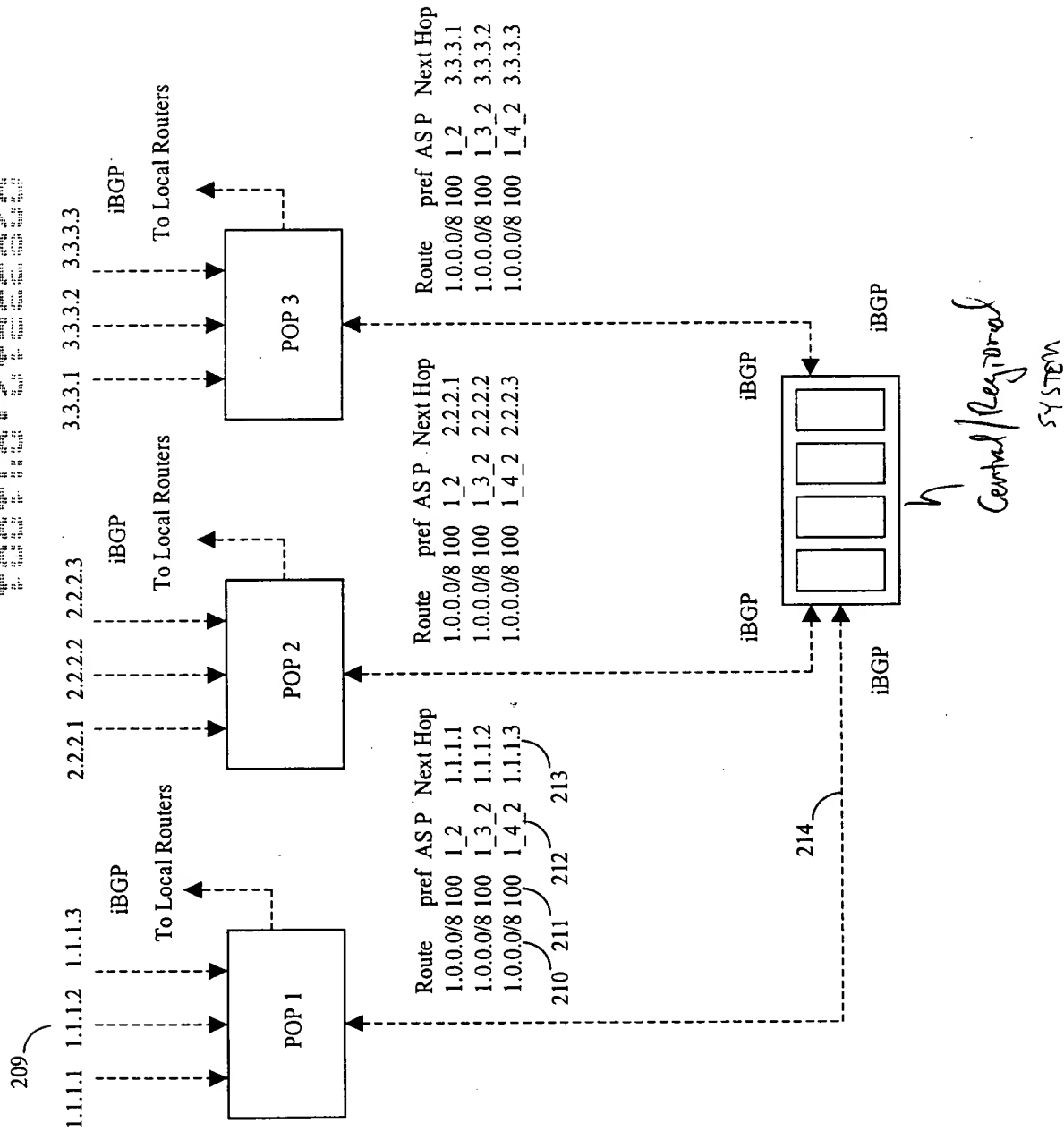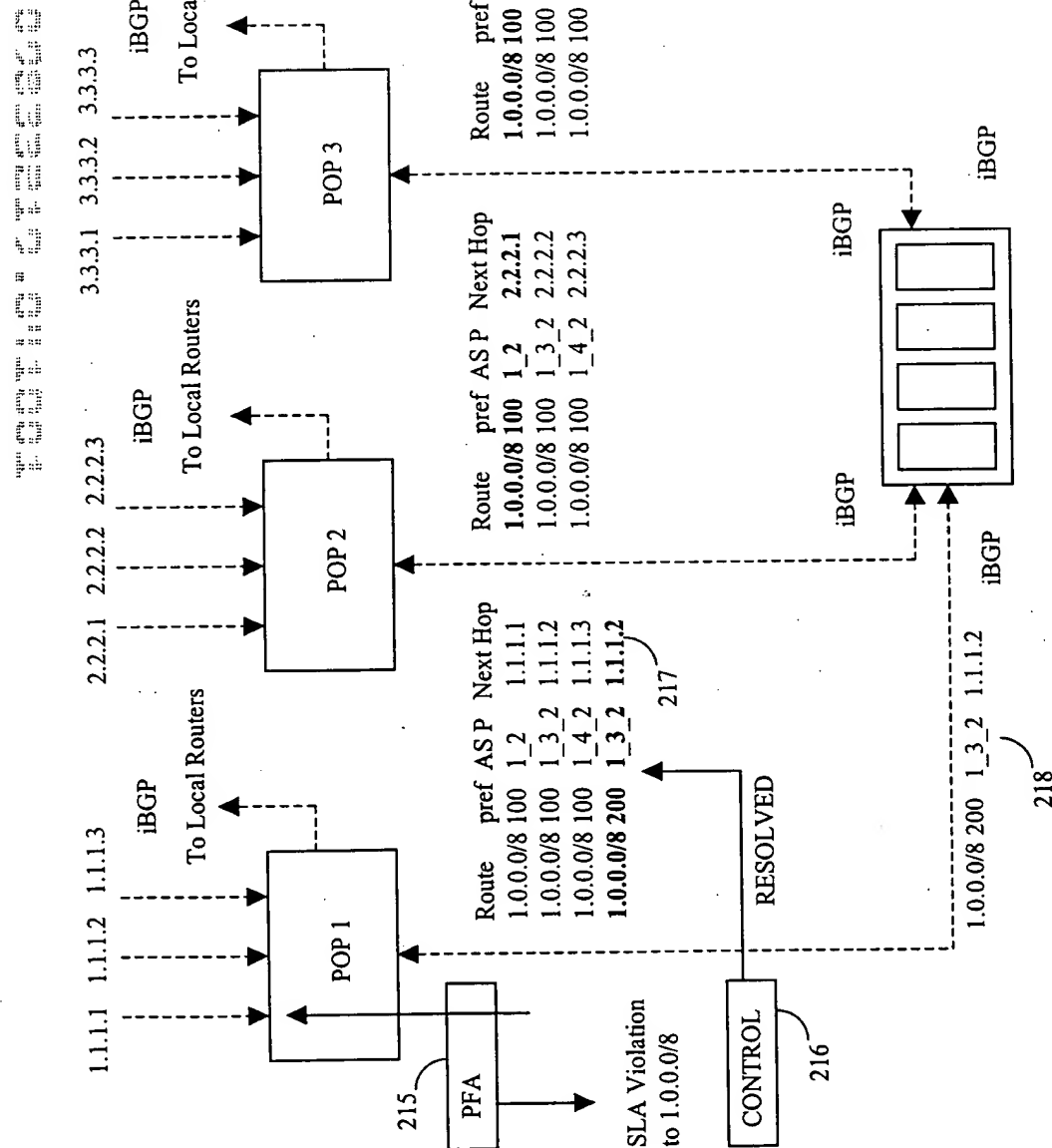Townsend and Townsend and Crew LLP   21 of 23
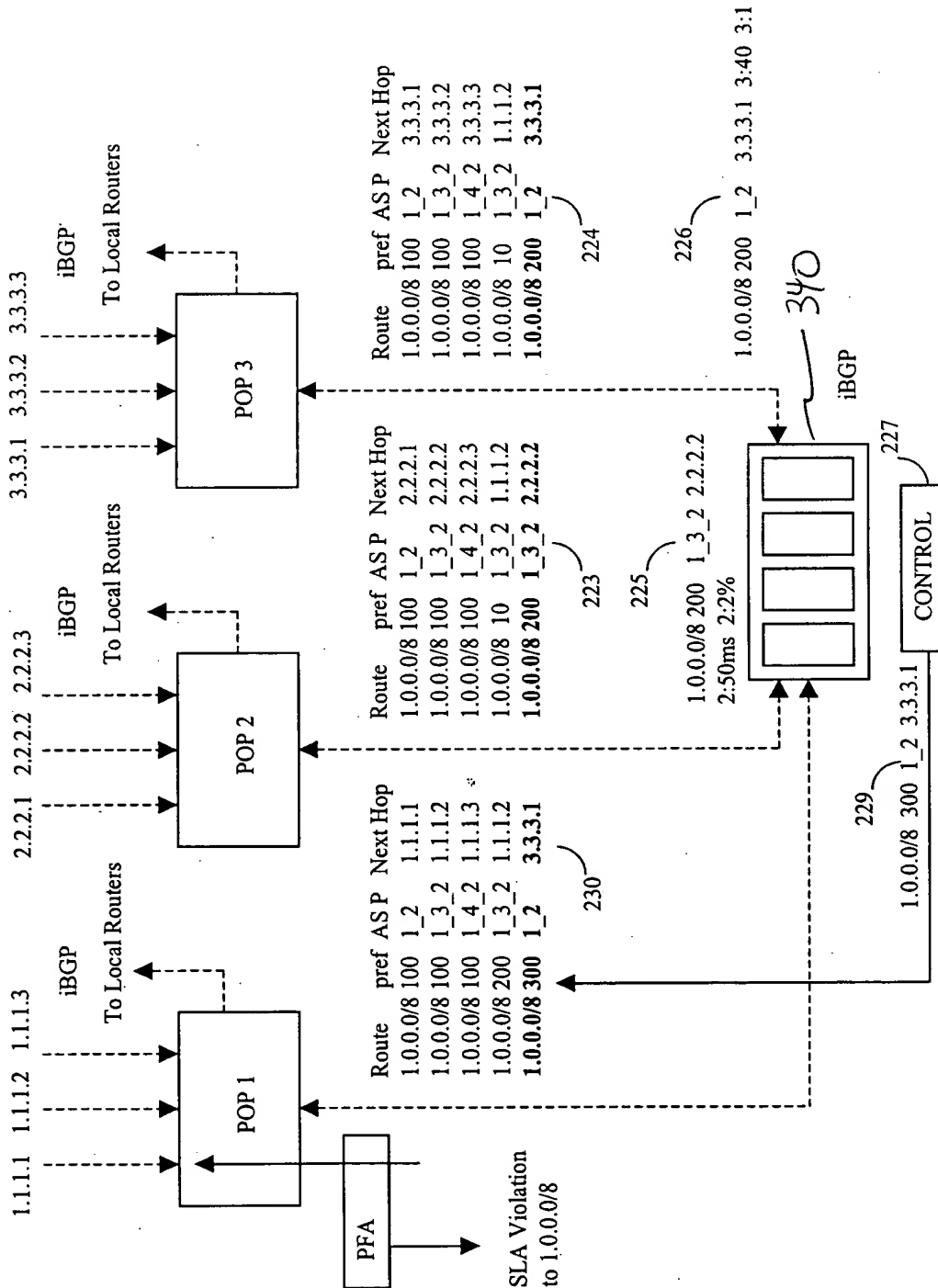
POP 1

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	1.1.1.1
1.0.0.0/8	100	1_3_2	1.1.1.2
1.0.0.0/8	100	1_4_2	1.1.1.3
1.0.0.0/8	200	1_3_2	1.1.1.2
1.0.0.0/8	**300**	**1_2**	**3.3.3.1**

POP 2

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	2.2.2.1
1.0.0.0/8	100	1_3_2	2.2.2.2
1.0.0.0/8	100	1_4_2	2.2.2.3
1.0.0.0/8	**200**	**1_3_2**	**2.2.2.2**

235

POP 3

Route	pref	AS P	Next Hop
1.0.0.0/8	100	1_2	3.3.3.1
1.0.0.0/8	100	1_3_2	3.3.3.2
1.0.0.0/8	100	1_4_2	3.3.3.3
1.0.0.0/8	**200**	**1_2**	**3.3.3.1**

236

iBGP To Local Routers

1.1.1.1 1.1.1.2 1.1.1.3
2.2.2.1 2.2.2.2 2.2.2.3
3.3.3.1 3.3.3.2 3.3.3.3

PFA — NO SLA Violation to 1.0.0.0/8

CONTROL 362

RESOLVED UPDATE ROUTE 231

1.0.0.0/8 200 1_3_2 1.1.1.2 232

CONTROL — Revoke 10 pref routes 234

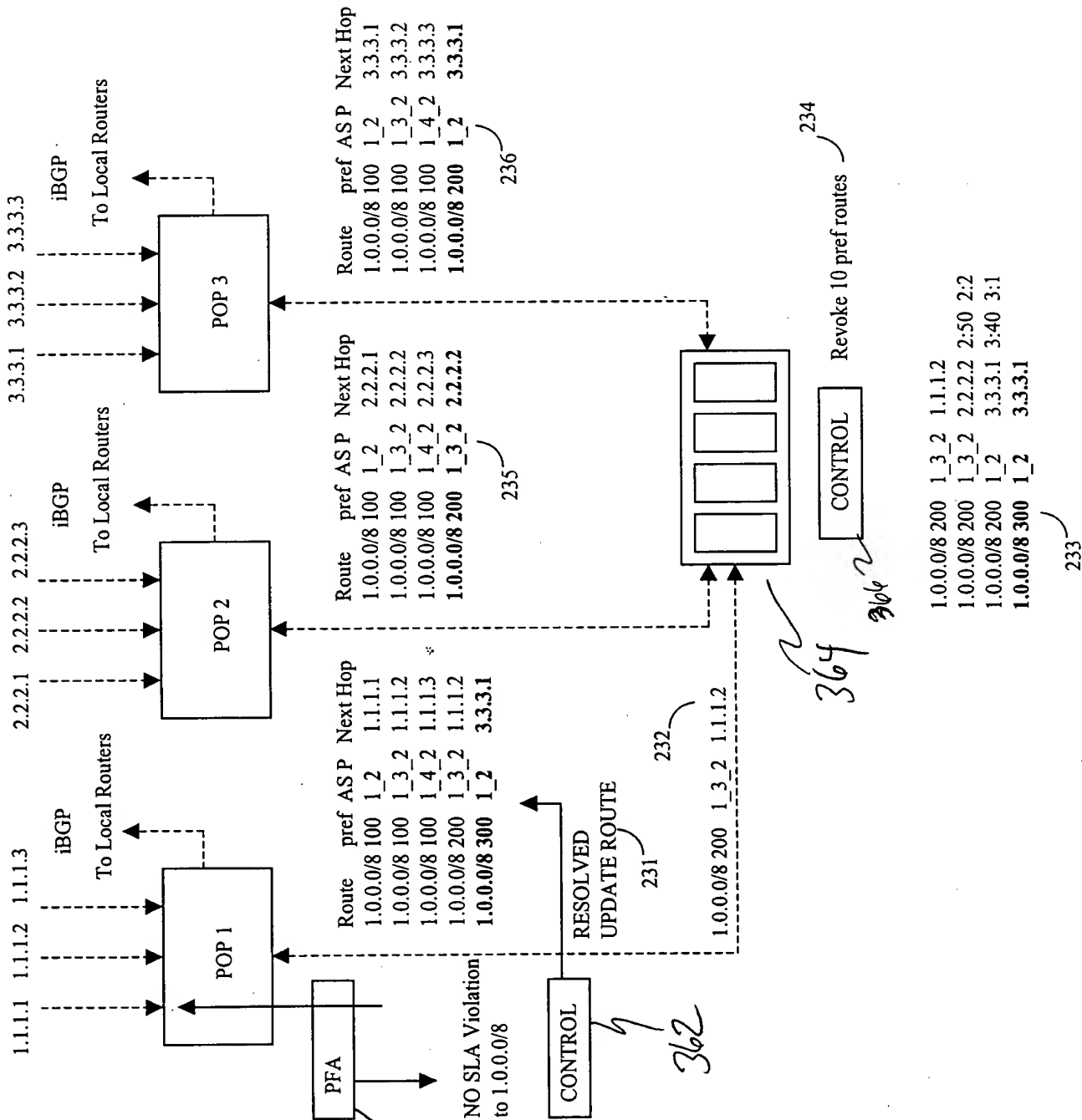| 1.0.0.0/8 | 200 | 1_3_2 | 1.1.1.2 | | |
1.0.0.0/8	200	1_3_2	2.2.2.2	2:50	2:2
1.0.0.0/8	200	1_2	3.3.3.1	3:40	3:1
1.0.0.0/8	**300**	**1_2**	**3.3.3.1**		

233

364 366 362

FIG 19

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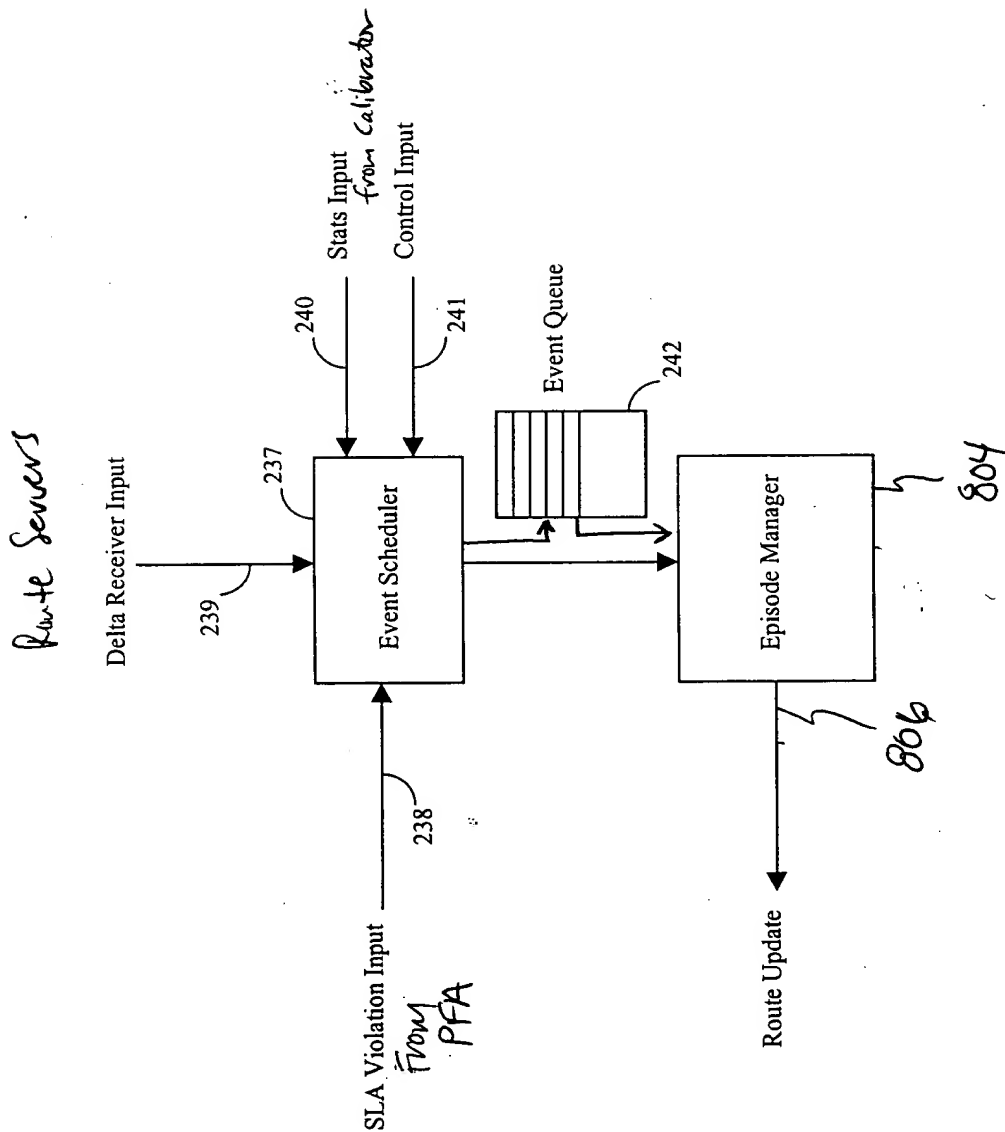Townsend and Townsend and Crew LLP   22 of 23

Route Servers

Stats Input *from Calibrator*

Control Input

Event Queue

Delta Receiver Input

239

240

241

242

237

Event Scheduler

Episode Manager

804

238

806

SLA Violation Input *from PFA*

Route Update

FIG. 20

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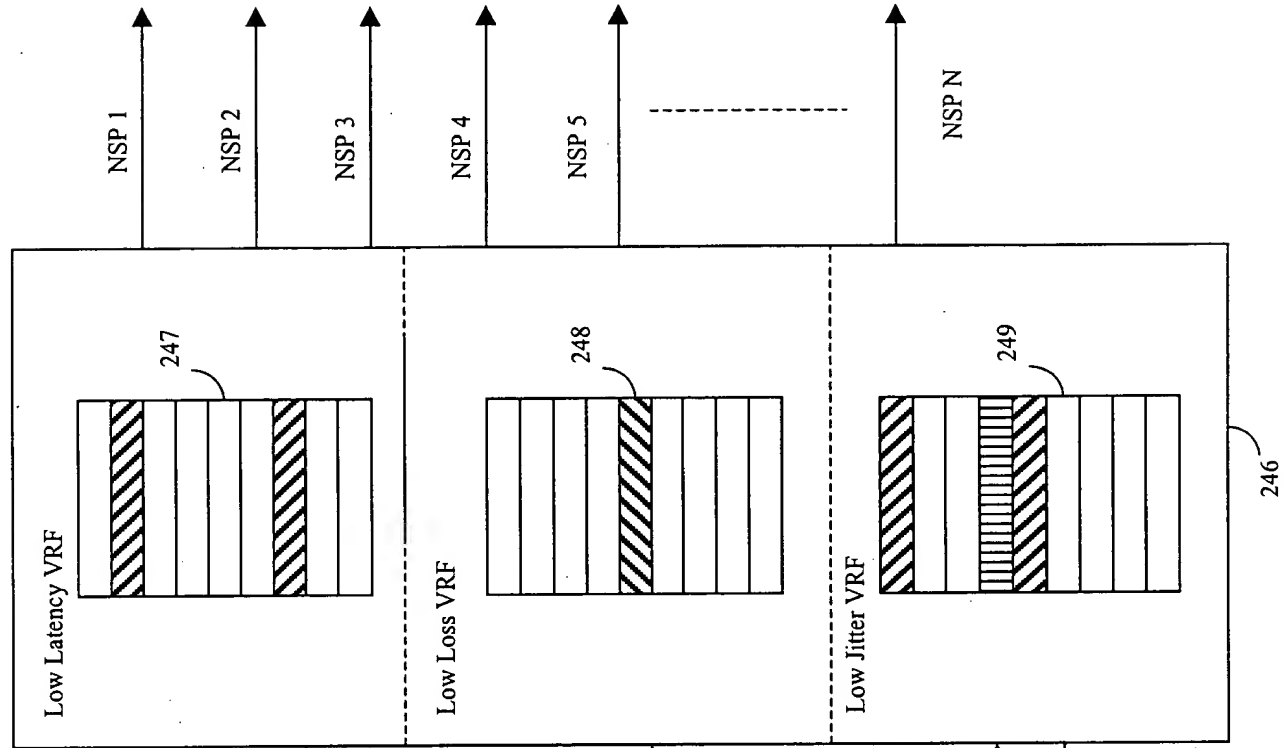
FIG 21